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THE TIMBER CRUISER.
HIS RELATION TO TIMBER BONDS

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With Marwick, Mitchell & Co., New York and Chicago.

Without the services of the timber cruiser—a man of physical hardihood, good mental training, peculiar personal skill and honor—the lumber industry and timber investment business of to-day would be of small proportions. Based upon the reports prepared by the skilled labor and good judgment of the expert estimator, some of the largest outlays of capital known in business have been made. The investors who have millions tied up in timber lands, the banks that have bought large issues of timber bonds, and the operators who are to-day cutting and marketing the world's supply of lumber, all have depended upon the judgment of some timber cruiser.

Timber cruising is one of the most picturesque callings known to the business world. The cruiser, however, that you may have met in some small hotel near the woods you would scarcely class as a representative business man. He probably stalked into the little hotel wearing a rough suit, slouch hat, heavy boots and leggings; from his shoulder hung a pouch of leather containing a compass, a tape line, a note book and if in mountainous country an aneroid barometer; at his belt a small axe swung in a sheath and in rare cases he may carry a rifle or pistol. After he has washed and had a good meal you will probably see him humped over the writing table laboriously computing the notes in his book by the dim light found in such resting places for man. Again, he may, instead of stopping at the little hotel, be enjoying the hospitality of some lonely squatter or homesteader in his little cabin, telling of the outer world and bringing a little cheer to this lonesome outpost of civilization. Or yet, again, you may find him with a little more baggage in the way of a pack sack containing his blankets, bacon, flour, salt, etc., and camping at night beneath some sheltering tree beside a spring or stream. In this latter case he will probably have as a companion a compassman, who will run his lines and help in

packing and cooking. Thus you will see that the cruiser beside knowing timber must be somewhat of a mathematician, a guide, a cook, a pack horse and a surveyor.

When the cruiser has covered the appointed territory, he can, if he has done his work thoroughly and honestly, report with an astonishing degree of accuracy, how many million feet of lumber there is on the tract he has examined. He will tell the different species on the tract and the various sizes of the trees of each species. He will also be able to state the logging conditions and the general character and topography of the country.

There are, of course, many different degrees of thoroughness with which the work may be performed. As regards honesty there are also, unfortunately, more standards than one. There have been too many instances where cruises have been made and the quantity reported as double or even triple the actual amount of timber found, or where outside property has been cruised and the timber on it reported as being upon the lands under consideration. Often in the prospectus of a bond issue there will be seen this statement "I have gone over this property and checked various sections and find that a conservative average is from 25,000 to 30,000 feet per acre." The chances are that the checks were taken in especially heavy growth and that more likely the general average is not over one-half of the figures stated. How is the investor to know that his bonds are properly secured and that the cruise of the timber is correct? He of course relies on the integrity and standing of the underwriter or banking house making the offer of the bonds, but at the same time he should insist that the cruise has been made by a responsible firm and that it has been thorough.

Cruises are often made in a haphazard way as sometimes those employing the cruisers will not pay the price for a thorough examination. Frequently such cruises are mere estimates formed by the cruisers walking or riding through the tracts and guessing at what they contain. Some cruisers will claim that even by such methods they can give a fair estimate of the contents of a forest, but as the basis of a bond issue such an estimate is manifestly unreliable. A more thorough inspection besides bringing out a very accurate estimate of the timber qualities will allow of a careful study to be made of the general conditions affecting the whole project. A report can thus be made that will give an investor an opportunity

of judging of the value of the timber and of the other resources instead of simply giving him a bald statement of the number of feet of timber estimated to be on the property.

In addition to a detailed report as to the quantity of each species divided into several sizes, the cruiser should give the number of poles which may be cut upon the property, the amount of small timber available for posts and ties and also an estimate of the amount of cord and pulp wood that might be got out by utilization of the tops, branches and small trees. If there is much hemlock on the tract he should estimate the cords of bark which could be used for tanning purposes; if the majority of the timber is long or short leaf pine, he should report upon the quantity of small trees or reproductive areas, as the conservation of the pine forests may be carried out at small expense in many localities if the amount of the reproductive areas is known. He should also give full particulars of the topography of the country and prepare accurate maps showing the streams and other essential details for a logging proposition. For each tract he should submit a logging scheme showing the best way to bring the logs down, with notes of rapids, obstructions and other difficulties. A general review of the situation as regards the available mills, or mill sites, or the possibility of erecting new mills, and the markets they would supply will also add to the value of a cruising report. A report on the availability of the land for agricultural purposes after it has been cleared, also a note of any surface indications of minerals, will be of interest.

When it has been determined that certain tracts are to be cruised, the cruisers are notified to meet the supervising engineer on a certain date at the nearest point to the property. In the meantime he has gone to the point, after procuring all maps and survey data possible relating to the tract, and arranged for transportation, outfit and supplies for his men. If the country is thickly settled it is usual to quarter the cruisers at a local hotel or in some farm house, but if there are large areas to be covered and few houses or cabins, a camp outfit is put in use, a good cook engaged and supplies purchased. Local men familiar with the country are engaged as compassmen or to guide the cruisers to the designated property corners in order that no time may be lost.

When the cruisers arrive a start is at once made and certain territory is assigned to each. If the tracts are small and scattered,

each cruiser takes his map and data, his compassman and such supplies as he may need and starts out. Otherwise the camp is moved to the center of the large area or as near as the location of drinking water will permit, and the cruisers work from that point, the camp being moved as often as necessary in order that the men may not be obliged to walk too far to reach the tract they are cruising.

The first duty of the cruiser is to locate one of the corners of the tract he is to cruise. If in one of those regions where the government surveyors have laid off the area into townships and sections, this is comparatively easy, but if in some of the states where other methods govern it may be more or less of a problem. In south-eastern Texas, for instance, the old Spanish vara, equal to $33\frac{1}{2}$ inches is the unit of measurement and the land is all held by grants, some of them dating back to the time when Texas was a Mexican colony. After locating the corner, the cruiser looks over the survey data or map and finds the bearing of the lines meeting at this corner. His compassman then starts out along one of these lines, following the direction by compass, after making the proper allowance for the variation of the needle, and paces the distance, using a length of step which will give him two thousand paces per mile. He does not walk along with his eyes fixed upon the compass, but after noting the direction he is to go he picks out some conspicuous tree on that line and with his eyes on that he moves forward in a straight line. When he reaches the tree he has been using as a guide he again refers to his compass and picks out another tree on the line and so continues until he reaches the required point. The compass used may be either a hand instrument called a military compass, or the more cumbersome but also more accurate one, known as a staff compass, which has a staff for placing it erect and a screw for setting off the variation of the needle.

For illustration, we will suppose the tract to be covered is a section of one square mile, or 640 acres. The compassman starts from the southwest corner and runs his line east. If he is working sections 31, 32, 33, 34, 35 or 36 he will probably find the south line fairly well blazed, as this is the south line of one township and the north line of another. He will count his paces by counting the right foot only and keep the count with a tally register. At a short distance to his right the cruiser will walk, scanning the trees, judging their heights, diameters, species, defects, such as punk

spots, burns, etc. When the compassman has stepped off seventy-six paces he calls out "check" and stops. The cruiser then proceeds to count all the trees of merchantable size between the starting point and the point where the compassman stands, and to a distance to the compassman's right equal to seventy-six paces. This gives a square area of one acre. The cruiser counts and estimates the quantity of timber of each species and in the various sizes and enters the quantities in his note book. It is wonderful how accurately an experienced cruiser, simply by looking at it, will estimate the number of feet there can be sawed out of a particular tree. He usually, however, carries a rule or a caliper rule and measures the diameter of a number of the trees in order to check his estimating ability. In very valuable timber he will measure every tree and call the figures to his compassman, who keeps the tally. After estimating this sample area he calls "all right" and the compassman then starts forward. When he has completed two hundred and fifty paces from the starting point he calls "tally" and goes on until he has made seventy-six paces more when he again calls "check." When he called "tally" the cruiser again began to count and estimate the trees on this sample acre, noting where the compassman called "tally" so he could gauge his distance correctly.

Between the sample acres the cruiser has been busy noting the condition of the trees which he does not count, as their condition as compared with the sample acre will determine certain modifications he will make in his estimate of the next sample acre, so as to give a true average of the timber as it stands. This is something which cannot be learned from books and which is based entirely on the previous experience of the cruiser. The two men follow this procedure until they have covered two thousand paces, or one mile. A good compassman, on fairly level ground, will find within a step or two of his two thousandth step the post or tree indicating the other corner of the section. At this corner, the southeast, the compassman will turn north and step a distance of two hundred and fifty paces, taking checks as before, and then will turn west and cross the tract again taking checks as before except that the cruiser will follow behind the compassman and in taking his checks will cover thirty-eight paces on either side of the line. At the west line they again turn north two hundred and fifty paces then back across the section. This is kept up until the entire section is covered

and an actual count and estimate has been made of eighty sample acres or one-eighth of the entire tract. This should give a very close estimate of the section and is sufficiently accurate for most purposes. On very small areas, however, where the timber is extremely valuable or where there is a dispute to be settled, the check acres may be taken one hundred and twenty-five paces apart each way, which will give an actual count of one-third of the entire tract.

To assist him in making a map of the area, showing the location of the various species of trees, streams, roads, railroads, clearings, tramway lines, burned areas, windfalls and other features necessary to a proper report, the cruiser has on the right hand side of his note book a rough sketch of the area, and as the compassman crosses these various features he calls out the distance. At the fences, roads and railroads he will make a note of the bearing of the lines and usually pace the distance along small clearings, locate the buildings and insert other data.

When the cruiser and his compassman have returned to camp, cleaned up, and eaten a good meal, they get out the report blanks, scale, protractor, and proceed to add up and verify their checks, draw a map on the report blanks and set down all the data that will go to make up the completed report. They first add up all the checks for each diameter and species of tree, multiply the sum of each series of checks by the number of acres in the area of the tract and then divide by the number of checks they have taken. The result is the amount of each diameter and species on the area.

While the cruiser has been estimating he had also made notes of the average number of 16-foot logs per tree which can be cut from each kind; whether there is any large number burned, blown down, or infested with worms; the method of logging the area to the best advantage. All these features he notes on his report, and it is usually late and dark before he has it in shape.

Perhaps the cruiser before starting his work learns that the government surveys are very poorly done, or that the lines have been run so many years ago that they are hard to discern, or possibly he is in a section of country where the tracts are irregular and the survey lines barely marked. In that case his work is complicated, because his first duty will be to establish the boundary lines of the property in order that he may be able to compute the area and the amount of timber correctly. He locates one of the corners, but in

order to do this he may be obliged to go back one or two miles to a known corner and re-run the lines. Then he runs the outside lines of the property, taking checks all the way around, and blazing the trees on the line at every tally point. Thus he has guiding marks when he commences his checks across the property. It is also possible that the parties for whom the cruising is being done desire the report to show the amount of timber by forties instead of by full sections, in which case the cruiser will make his computations for each forty acres of the section instead of the entire area. Another modification that may be made in the check acres is to take checks every one hundred paces and to count and estimate the trees in a circle whose radius is twenty-six paces. This gives a third of an acre as a check and by taking checks every one hundred paces in each direction on a section of 640 acres an accurate estimate of one hundred and thirty-three acres is obtained. Some cruisers prefer this method as, after the compassman has called "tally" he steps off thirteen paces and halts. The cruiser then using the compassman as a center, walks around him at a distance of thirteen paces and thus is able to see, without any doubts, every tree on the area of one third of an acre.

During the course of a cruise as outlined above, the supervising engineer has been gathering other data of interest, getting supplies to the men and dropping in on the various camps unexpectedly. He may take his horse and head cross-country to where a certain cruiser is working and come on him at work. In this way all of them are keyed up to do their best. He also rides through the tracts and makes notes of the species, burnings, and exact conditions. When the reports come before him, before going to the office for final drafting, he is thus enabled to rectify discrepancies and errors. Another thing that should be, but is not often done, is to take one of the best cruisers and send him out to check the work done by the others. This adds to the accuracy of the work and though it adds to the cost, is worth all the trouble and expense in keeping the men up to the mark.

As the cruising of the different tracts is completed, the reports after having been passed upon by the supervising engineer are forwarded to the office of the firm that has the contract for the work. There the final maps are made, the figures and computations checked, and the complete report prepared.

With a cruise made in this manner, and vouched for by a reputable firm, the investor in timber bonds has all the authoritative information that can be obtained in regard to the amount and quality of timber on the property.

The conditions, of course, are more complicated in a wild country which has not been surveyed and of which there is meager knowledge as to the relative location of streams, mountains or other landmarks. Take, for instance, a cruise of virgin timber in western Canada where not even base lines have been surveyed, and where the timber has been located probably by a man walking up the frozen streams and at a likely point locating a corner. This he did by cutting down a small tree leaving a stump about six feet high, which he squared near the top and placed his description on one face with a pencil or by pinning on a typewritten sheet brought from town. After one or two winters these descriptions in all probability have been washed away except in the rare instances where an indelible pencil has been used, or the locator cut the words with his knife.

The cruiser in such a country must, therefore, to a large extent, depend upon local men who have hunted and trapped in these wilds, or upon the actual locators. He must also use his own good judgment as to many of the features.

Even with all these difficulties it is possible to get a very close estimate of the amount of timber standing upon the property by using care and not taking anything for granted. However, it is not often that such precautions are taken, and it is regrettable that so many bond issues have been floated recently upon western Canada timber, based upon a so-called cruise, but which has been only a cursory examination of the more accessible and best covered tracts. The results stated on such a basis are, of course, far in excess of the actual amounts which will eventually be cut on the tract.

As a continuing element of security in connection with all bonded timber properties it would be advisable to have periodic reports made by a cruising firm. This would not necessarily entail a cruise, as the annual report of the amount cut should show the amount still standing on the property, but a general inspection might be made to determine whether the timber is being cut to advantage, whether the mill cut is "overrunning" or "underrunning" the estimate, and whether the timber is being utilized to the best interests of the bond and stockholders.